

ON THE ANNUAL MOLT OF THE SANDERLING.

BY WITMER STONE.

In March, 1896, Mr. Frank M. Chapman published a paper entitled "The Changes of Plumage in the Dunlin and Sanderling,"¹ his object being chiefly to controvert the theory of Gätke and others that these and other birds acquired their nuptial dress by an actual change in the color of the feathers of the winter plumage.

Mr. Chapman demonstrates conclusively, with the aid of a large series of specimens, that this change is effected by an absolute replacement of the old plumage by new and differently colored feathers.² In the case of the Sanderling, *Calidris arenaria*, Mr. Chapman describes the plumage changes of the bird in some detail, and in speaking of the annual molt says:—

"There is no reason to doubt that the Sanderling, like other birds, undergoes a complete molt after the breeding season; nevertheless, not one of my twenty August specimens shows any signs of molt in progress in the wings or tail. In the larger number, however, the remiges and rectrices are in an apparently fresh and unworn condition, and I assume that in most cases these important feathers are acquired before the migration is begun. This would be in July, a month which, as I have said, is not represented in my series."

At the time this was published I agreed quite as fully with this view as I do with the other conclusions reached by the author in his admirable paper, but specimens recently submitted to me by my friend Mr. William L. Baily, taken at Cape May, N. J., August 14th, 1897, show the flight feathers in full molt, and prove that the molt of these feathers does not *always* take place *before* the migration, while subsequent examination of additional material leads me to think that in the large majority of cases they do not *begin* to molt until the migration has begun.

These Cape May specimens also tend to emphasize a fact which Mr. Chapman has curiously enough stated in the sentence immediately preceeding the one above quoted, and which all who have studied molts know to be only too true, viz.: "the necessity for

¹ Bull. Amer. Mus. Nat. Hist., Vol. VIII, pp. 1-8.

² The author pointed out the same fact independently in a paper which appeared April 14, 1896. Proc. Acad. Nat. Sci. Phila., 1896, p. 125.

large series in studying the molt and the erroneous conclusions which may be drawn from negative evidence."

In investigating the annual molt of the Sanderling, I had before me a series of sixty-seven skins taken from May to November, including besides those in the collection of the Academy of Natural Sciences of Philadelphia, a series from the U. S. National Museum and the American Museum of Natural History, kindly loaned by the authorities of these institutions.

The series of spring specimens which I have examined serves but to substantiate Mr. Chapman's account of the spring molt, and is not concerned with the present paper.

My series may be grouped as follows:—

Birds of the year in first plumage, 19 (Aug. 26th to Oct. 20th).

Birds of the year showing molt of the body feathers, 9 (Sept. 29th to Nov. 10th).

Old birds in nuptial plumage, 8 (May 21st to Aug. 14th).

Old birds showing molt, 28 (Aug. 2nd to Oct. 31st), 8 of which (Aug. 14th to Oct. 31st) show molt in the primaries.

Old birds in full winter plumage, 3.

The birds of the year, as is well known, molt the body plumage in the autumn and the black and white feathers of the back and head are replaced by light gray as in the winter adults.

The following table shows the progress of this molt:—

U. S. N. M., 106,443, Romney, Eng., Aug. 29th, one or two gray feathers.

A. M. N. H., 54,698, Devon, Eng., Sept. 10th, one or two gray feathers.

A. N. S. P., 34,169, Beach Haven, N. J., October, about 25 gray feathers.

U. S. N. M., 128,796, Aldabra Isl., Africa, Nov. 10th, about half the feathers gray.

U. S. N. M., 41,774, Merida, Yucatan, about half the feathers gray.

A. N. S. P., 34,873, Wolfville, N. S., Sept. 29th, gray feathers predominating.

U. S. N. M., 81,754, Ventura, Cal., Nov. 2d, molt complete.

Other specimens from Wolfville, N. S., taken Sept. 29th, and one from Havre, France, Oct. 20th, have not begun to change.

This shows the great variation in the time of the molt.

Some species of birds molt their remiges and rectrices with the first body plumage, but none of the specimens examined show any evidence of such molt in the Sanderling.

The possibility that some of the specimens described below which show molt in the primaries were birds of the year was considered, but all the evidence seemed to point to their being adults.

I feel convinced that the black tips to the wing and tail coverts will serve to distinguish birds of the year as pointed out by Mr. Chapman, even after the black and white feathers of the back and head have been entirely replaced, as they are still retained in birds that have entirely finished the molt.

The specimens illustrating the annual molt of the adults may be arranged as follows:

A specimen from Glacier Valley, North Greenland, taken June 14 (A. N. S. P., 30,197), shows the full nuptial plumage as do other specimens from Cape May, N. J., May 21st to June 13th.

One from Cape May, August, 14th is in worn nuptial plumage with one or two gray feathers on the back, but no further sign of molt.

Eighteen other specimens (Aug. 2d to Sept. 11th) show a varying amount of gray feathers in the plumage of the upper surface, giving them a mottled appearance. In all of these the spotting on the breast is still perceptible, and in at least half of them scarcely any molt has occurred in this part of the plumage. In none of them is there any molt in progress in the wing or tail, even the wing coverts being in every instance the worn nuptial plumage.

The primaries show great diversity as to abrasion, some being much worn and bleached to a dull brownish tint, while others are much blacker and comparatively so fresh looking that Mr. Chapman considered them to be newly acquired feathers.

As stated below, however, I am inclined to consider them as belonging to the old nuptial plumage.³

³ In this connection attention should be called to the fact that in the Dunlin (*Tringa alpina pacifica*) the primaries are molted in June, (!) as is shown by every individual in a series of four collected in Alaska by Dr. Benj. Sharp, June 28-29, 1895 (Coll. Acad. Nat. Sci., Phila.). There is no trace of such a molt in the only breeding Sanderling that I have been able to examine, while we have positive evidence that some Sanderlings molt the primaries in August (see below).

Therefore, if the comparatively fresh appearance of the primaries in some of our mottled August birds indicates that they are newly acquired feathers, we must admit that there are two styles of molting in this one species, which seems unlikely—i. e., in some individuals a molt (in June or July) of the remiges, completed before the molt in the coverts or body plumage begins; and in others a molt (in August) of all the feathers, the remiges beginning when the body plumage is about half renewed.

A series of Knot taken in Greenland during June and July show no such molt as is exhibited in the Dunlin.

The specimens included in this mottled series are as follows:—

- A. M. N. H., 35,752, etc., 8 specimens, Chatham, Mass., Aug. 27th.
- W. S., 1,573, Cape May, N. J., Sept. 11th.
- U. S. N. M., 59,714, Tehuantepec, Mex., Aug. 5th.
- A. N. S. P., 33,744, 34,168, 2 spe'm'ns, Beach Haven, N. J., Aug. 21.
- U. S. N. M., 30,310, Spanishtown, Jam., Aug. 20.
- U. S. N. M., 94,714, Hyde Park, Ill., Aug. 20.
- U. S. N. M., 111,789, White I., Canada Bay, Aug. 2.
- U. S. N. M., 124,587, Pt. Lookout, Sept. 8th.
- U. S. N. M., 1,011, Devon, Eng., Aug. 26th.
- A. M. N. H., 51,171, Rockaway, L. I., Aug. 4th.

The next series of eight birds shows the continuation of the molt. In all of these the gray predominates on the back, many of them being practically like winter birds, having lost nearly all the old body feathers. In all, however, the molt is in progress in the remiges, and in most cases in the rectrices also, while in all but the most advanced, remains of the old wing coverts may be seen in varying quantity.

These birds in detail are as follows:—

	Last primary molted	Molt in secondaries	Molt in tertials.	Molt in wingcoverts	Molt on back.
Cape May, N. J., Aug 14..	4	None.	None.	Half completed.	About 20 old feathers remain.
Cape May, N. J., Aug 14..	4	None.	Half completed.	Half completed.	About 25 remain.
U. S. N. M., 151,633, Margarita Island, Venezuela, July 7.....	4	2 renewed	About completed	Almost completed	About 12 remain.
U. S. N. M., 128,795, Aldabra Isl., Oct. 8.....	4	All but 3 renewed.	Complete.	Complete.	Complete.
U. S. N. M., 128,793, Aldabra Isl., Oct. 8.....	4	Complete.	Complete.	Complete.	Complete.
U. S. N. M., 110,029, Kauai, Hawaiian Isl.....	3	All but 3 renewed.	Complete.	Complete.	Complete.
A. N. S. P., 26,178, Cape May, N. J., Sept. 14.....	2	Complete.	Complete.	Complete.	Several old feathers remain.
U. S. N. M., 102,064, Tambo Valley, Peru, Oct. 31.....	6	None.	Complete.	Nearly complete.	Several old feathers remain.

This shows great variability in the time of completing the molt and the relative progress of molt in different parts of the plumage.

One point which seems to be borne out by all the specimens is that the body plumage is pretty well renewed before the remiges begin to molt, and that consequently the molt of these feathers occurs after the bird starts on its migration.

If, as Mr. Chapman assumed, the mottled birds which showed no trace of molt in the remiges and rectrices, had already renewed these feathers, we would have a condition contrary to that found in any group of birds which I have examined, i. e., the completing of the molt of the remiges before the molt of the coverts begins.

Better evidence, however, is to be found in the fact that in some of the molting specimens above described the primaries that are being replaced are quite as fresh as those in the mottled birds already mentioned.

Why there should be this great difference in the wear of the remiges I am unable to say; and I am equally at a loss to account for the peculiar appearance of some birds in which the two outer primaries are in a wonderfully better state of preservation than the inner ones, the difference between the second and third being very marked. All the evidence so far seems to point to the same order of molt in the feathers of the wing of these birds as is seen in the *Passeres*.⁴

Two specimens given in the above table deserve special comment. The Margarita Island specimen is remarkable from the fact of its capture so far south at so early a date (July 7), as well as in having so nearly completed its molt. It may, perhaps, have been a wounded or diseased bird that did not migrate northward in the spring.⁵

The other specimen is the one from Tambo Valley, Peru, October 31st (U. S. N. M., 102,064), which has completed the body molt while the remiges are just beginning to change.

⁴ See Stone, Proc. Acad. Nat. Sci., 1896, p. 112.

⁵ For note on the capture of this specimen (No. 151,633, U. S. N. M.), see Proc. U. S. N. M., 1895, p. 656.

A specimen of *Ereunetes occidentalis* taken in San Domingo by Dr. W. L. Abbott, July 11, 1883 (No. 26,158, A. N. S. Phila.), is almost exactly like this as regards the state of its plumage, all the plumage being gray with the middle rectrices renewed and only the five outer primaries of the summer plumage remaining.